ELECTRICAL REVIEW

[ILLUSTRATED.]

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Description of Tangent, Sine, and Secant Galvanometer, Made by C. E. Jones & Bro., Cincinnati, Ohio.

FIG. 1.

A is the base upon which the instrument rests.

B, adjusting screws to level instrument. A circular level is placed on top of base, as shown in Fig. 2.

E, column supporting the arms *F*, *F'*, *F''*. It is held in position by spindle *T*, which passes through plate *D* and base *A*, and is secured by nut and washer *C*. This spindle, *T*, forms an axis for the instrument to revolve on.

D is a plate fixed firmly to column *E*, so as to revolve with it

U is a vernier on plate *D*, by which the degrees through which the instrument is turned, when used as a sine galvanometer, may be read, the degrees being marked on top of base *A*.

G, *G'* are two brass rings, ¾ and 1¼, *G* being 12 inches in diameter and *G'* 6 inches. These rings are grooved on the periphery, the grooves being filled with wire.

F, *F'*, *F''* are arms fixed to column *E*, which support the two brass rings and needle box, allowing the rings to be turned from a vertical to a horizontal position, being supported on shafts *g*, *g'*.

R, *R*, *R*, *R* are hard rubber blocks fixed to brass rings, to which the shafts *g*, *g'* are attached for the purpose of insulating shafts from rings.

S, *S*, *S*, *S* are insulated binding posts, to which the different wires in rings are attached.

O, *O'* is a quadrant graduated into degrees, and fixed firmly to arm *F'*.

P, *P'* is a vernier fixed firmly to *g*, *g'*, and revolves with it, for the purpose of showing the number of degrees through which the rings *G* and *G'* are inclined.

H is the needle-box, supported by arm *F''*.

J is glass cover of box.

L is a magnetized needle one inch long, with aluminum pointers, supported by silk fiber *V*.

M is a pendulum attached to needle, to prevent its dipping when a strong current is passed through the rings when in an inclined position.

N is a dampener to prevent needle from swinging too violently, and to bring needle to zero readily.

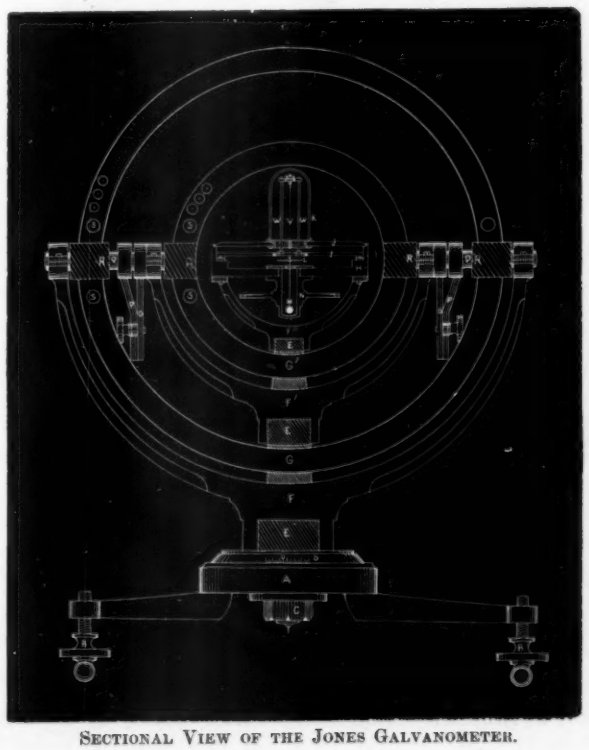
I is a cross-bar supporting the columns *W*, *W'*, which support silk fiber.

K is a glass case, covering fiber and its support.

This instrument has the capacity to measure the heaviest or strongest electric light or dynamo currents, as well as the most feeble and delicate currents from batteries, giving the strength of current in amperes; also of measuring high or low electromotive force in volts. The wide range of usefulness of this instrument, covering almost the entire field, justly entitles it to the name we have given it—A UNIVERSAL COMBINATION TANGENT, SINE, AND SECANT GALVANOMETER. It may be used in conjunction with a rheostat for measuring small or large resistances, having various coils adapted to this purpose.

It can be converted into a *dead beat instrument* by filling the chamber in which the pendulum of the needle hangs with glycerine. Its value as an instrument of precision is very much enhanced from the fact that it embodies three methods—the tangential, sine, and secant—of obtaining similar results, and each may be verified by the other.

THE JONES TANGENT, SINE, AND SECANT GALVANOMETER.



SECTIONAL VIEW OF THE JONES GALVANOMETER.

The rings are the conductors for the more powerful dynamo currents.

The small ring has four different coils of specially uniform drawn copper wire, and one coil of German silver wire. The large ring has one coil of similar copper wire, and also one of German silver.

The wire on this instrument was made specially to order, of the purest copper and almost absolute uniformity of gauge (having been drawn through ruby dies), by the American Electric Works, of Providence, R. I.

The metal of which the instrument is constructed was very carefully selected, and manipulated until it was almost chemically pure.

The following table gives the resistance of all the different coils, and also the calibration for current and electromotive force.

Calibration of the Combination Tangent, Sine, and Secant Galvanometer, made by C. E. Jones & Bro., Cincinnati, O.

	Ohms resistance.	Constant for current in amperes.	Constant for E. M. F. in volts.
SMALL RING.			
Ring itself	nil 0.	2.37	
1st coil, No. 22 sc. copr	0.88	.009	
2d " No 22 "	1.07	.....	
3d " No. 26 "	9.45	.....	
4th " No. 28 "	27.4	.....	
5th " 6 ozs. No. 30 German silver	250C.	.....	6.25
LARGE RING.			
Ring itself	nil 0.	4.23	
1st coil, No. 22 copper wire	3.34	.....	
2d " 1¼ lb. No. 30 German silver	7400.	.....	31.61
5th coil of small ring and 2d coil of large ring, combined current passed through coils in opposite directions, or differentially	9900.	.....	62.82

To measure strength of current in amperes, the instrument having been once calibrated, it is only necessary to pass the current, which it is desired to measure through the first or small ring for instance, and note the deflection, then find the tangent of this deflection and multiply the tangent by the constant, the product will be the required answer in amperes.

Suppose we wished to measure a dynamo capable of operating ten arc lamps: We would proceed by placing the small ring of the galvanometer in circuit with the lamps, and note the deflection, which we will assume to be 67°. The tangent of 67° is 2.35, the constant of small ring according to the table is 2.37 amperes; the product of tangent 2.35 and constant 2.37 gives 5.57 amperes, which would be the strength of current the dynamo was giving off.

Suppose we wish to measure the current from a dynamo capable of operating 100 incandescent lamps: Connect the leading wire through the large ring, the needle will very likely deflect to 90°, but readings are not very accurate or reliable when taken beyond 75°. By inclining the rings we can reduce the deflection to any desired degree. If we move the ring into a horizontal position, the needle will immediately respond by returning to zero. The current has no effect on the needle when passing around it horizontally.

Each ring is provided with a vernier, which gives accurate readings in minutes for the respective angles of inclination of the rings.

The strength of the current will now be equal to the product of the tangent of the angle of deflection by the secant of inclination, times the constant.

Suppose we now tip the ring until we get a deflection of 65° on the needle, and by consulting the vernier we find the inclination to be 75°.

The constant of large ring as given in the table is 4.23 amperes.

The tangent of 65° is 2.14; the secant of 75° is 3.86; the product of tangent 2.14 and secant 3.86, and constant 4.23 gives 34.94 amperes, or the strength of current.

To measure still heavier currents the rings may be connected up differentially.

To measure potential in volts we proceed in a similar manner, using the high German silver resistance coils, instead of the rings.

The constant for coil on small ring is 6.25 volts; with coil inclined to 85° and needle deflected to 65°, we would get a potential of 215.87 volts, the product of the tangent 2.14 times the secant, 11.47 times constant 6.25. This would be practically the limit of this coil.

For higher potential the larger coil would be used, in which seven hundred and seventy-five to eight hundred volts can be measured.

Still higher potential up to 1,500 or 2,000 volts can be measured by combining the coils on both rings differentially.

When used as a sine galvanometer, the degrees through which the instrument is turned are read off at the base.

Laws of Magnetic Attraction.

By P. H. Van der Weyde.
President of the New York Electrical Society.

Under the head of "Magnetic Induction" is found, on page 5 of the Electrical Review for April 11, an account of experiments with a permanent magnet tending to prove that "the law of attraction of horse-shoe magnets departs from that of *inversely as the square of the distance.*" Without attempting to settle this much-disputed problem, I may be allowed to make a few critical remarks upon some principles which should be kept in view when making deductions from such experiments.

It is a geometrical truth that the surfaces of spheres are proportional to the squares of the radii; consequently force, or action proceeding from a center equally in all directions, must be diffused over the surfaces in the same proportion, and equal parts of surface take on spheres of different dimensions, must receive actions in the inverse ratio of square of the radii, or distances from the acting center. That means that a surface of, say, a square inch, on a sphere of one foot radius, will be acted upon by the force in its center with a four times greater intensity than it acts upon a square inch on a sphere of two feet radius, and nine times as strong as it is on every square inch of a spherical surface of three feet radius, etc. Consequently, the total amount of action received by the whole surface of each sphere is equal, whatever be its dimensions, provided the action proceeding from the center is the same.

This is the case with light. The illumination obtained by any object is inversely proportional to the square of the distance. It is the same with gravitation, provided the central action proceeds from a point, or the distance in question is large enough to consider the dimensions of the acting center comparatively as a point, without an error of any practical importance. When this is not the case—for instance, when making photometric experiments with a large flat gas flame, at distances, say, only three or four times the width of the flame—the law of inverse squares does not hold. Of this any one who possesses the facilities for experimenting in this line may satisfy himself.

This, now, is exactly the case with the magnetic experiments, reported April 11. The various distances differ only $\frac{1}{60}$ of an inch, while the active parts are by no means points, but lines of nearly one inch in length when the armature is used on edge, or surfaces of almost a square inch when used flat. If such a large surface acts at so small a distance, it cannot be expected that the law of inverse squares could possibly hold, as this is only the case when the distances are so large that the dimensions of the acting center may be disregarded.

This was the basis upon which Mayce and Martin conducted their experiments. They found that the true law of magnetic force is identical with that of gravitation, namely, inversely proportioned to the square of the distances. They experimented by observing magnetized needles, measuring the angles of deflection at different distances, always large compared with the pole of the magnet. Lambert showed, further, that the force was directly proportional to the magnetic intensity (which depends upon the number of particles magnetized), while it was inversely proportional to the squares of the distances. If here, for magnetic intensity, we substitute mass, we have the identical law as that which prevails in universal gravitation, of which magnetic attraction is only a special and peculiar modification.

Fig. 2.—Carbon Cell Battery.

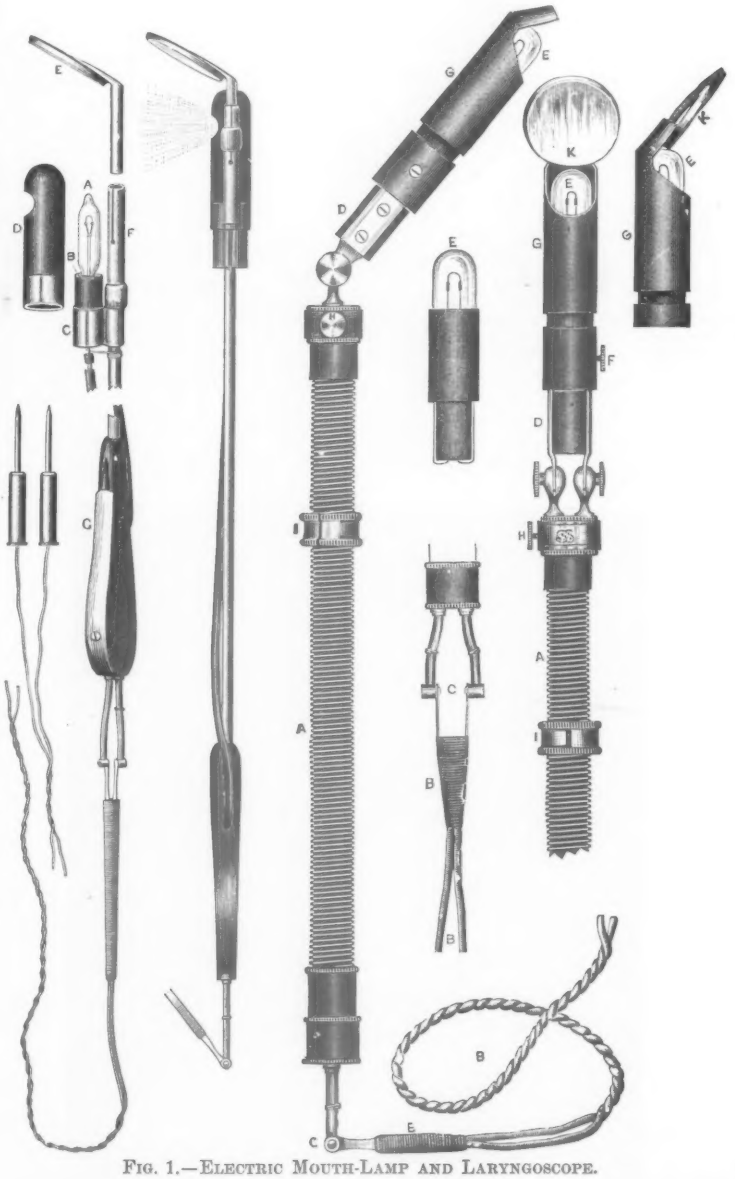


Fig. 1.—Electric Mouth-Lamp and Laryngoscope.

Another geometrical truth is that the curved surfaces of cylinders are proportional to their radii simply, and not to their squares, as is the case with spheres; consequently, force, or action proceeding from the whole length of the line of the axis towards the curved surfaces, must be diffused over these surfaces in the same proportion; and equal parts of the curved surfaces of cylinders, of different dimensions, must receive actions in the inverse ratio of the radii. That means that a curved surface of, say, one square inch, on a cylinder of one foot radius, will be acted upon by the linear central force with twice the intensity of that received by a square inch of surface of a cylinder of two feet radius, and three times as much as a square inch on a cylinder of three feet radius, etc. Consequently, the total amount of action received by the whole curved surface of all cylinders, whatever be their radii, is equal, provided the action proceeding from the linear axis is the same.

This is the case with light when it proceeds from a linear luminous body. This, by the way, is the reason that the incandescent electric lamp has, for small distances, a better carrying capacity than a small arc light of the same luminosity, which latter is the nearest approach we have to a luminous mathematical point, and therefore absolutely follows the law of the inverse squares; while the incandescent lamps, especially those with a long, straight filament, like the large Edison lamps, approach the law of the simple inverse distances, as long as these distances are only such as are common in rooms of moderate use. By twisting the filaments so as to diminish the total outline and concentrate the light in a smaller space, they approach to some extent the law of the inverse squares, and their carrying capacity is impeded.

The mutual action upon one another of wires carrying electric currents, and of linear conductors in general, follow the laws of simple inverse distance, and not of the squares, as was demonstrated by Ampere, when he showed that currents running in the same direction will attract one another, and running in opposite directions they will repel, and this always in the simple inverse ratio of the distance.

According to what has been shown, these facts and the laws deduced from them, are simply a result of the mathematical truth teaching the difference between the geometrical relations of spherical surfaces to their centers, and cylindrical surfaces to their axes.

There is still another consideration which, in the experiments recorded April 11, appears to have been wholly overlooked. It is that the insertion of two, three or four slips of cardboard of $\frac{1}{60}$ inch each in thickness, and used for the separation of the armature from the poles of the magnet, does by no means represent a two, three or four-fold distance from the attracting mass, for the simple reason that the magnetism does not reside on the surface of the pole, but in the mass of the steel, so that the center of attraction is situated at a certain depth, perhaps surpassing the thickness of several cardboards. If we call the depth n, the real distance of the armature from the center of magnetic attraction obtained by the insertion of the slips of cardboard are represented by $n+1$, $n+2$, $n+3$ etc.; and applying this to the results recorded April 11, we may attempt to determine the value of n, or we may test whether the simple inverse distances, their squares, as found by Major, their cube, as inferred by Newton, or their sesqui-duplicate ratio, as asserted by Hawksbee, are correct; or if perhaps old Musschenbroch was right, who, by researches, was led to the conclusion that no assignable proportion exists between the magnetic force and distances. This will be the subject of the next article.

At Rochester, last week, Judge Morgan granted an injunction restraining Cornelius R. Parsons, as President of the Rochester District Telegraph Company, and his associate officers, from issuing any of its treasury stock. The injunction was obtained by Harris & Harris, as attorneys for Hiram McGonegal, S. D. Lake, J. W. Frost, J. C. Kalbfleisch, and J. E. Burroughs, officers and stockholders of the company, owning 4,275 shares, a majority of all the stock They allege that Mayor Parsons and his friends control a majority of the board of directors and are endeavoring to get control of the business and run it in opposition to the wishes of those holding a majority of the stock. With this object in view J. W. Frost was deposed from his office of Secretary, at a meeting last Wednesday, of which no notice was given to the plaintiffs. There has also been great irregularity in the business methods of the managers, and the books do not correctly show the earnings or expenses.

The Missouri legislature finally decided to not order under ground all electric wires in the State, and has adjourned for two years. This will permit several very capable gentlemen connected with the electrical business to retire from politics and assume more congenial duties.

Medical Electricity.

We illustrate to-day some very interesting electrical apparatus used by the medical fraternity. These instruments are manufactured by the S. S. White Dental Manufacturing Company, of Philadelphia:

ELECTRIC MOUTH-LAMP AND LARYNGOSCOPE.

The electric mouth-lamp will be found an invaluable assistant to the dentist in diagnosing lesions of the teeth and associate parts, especially in those obscure parts where,

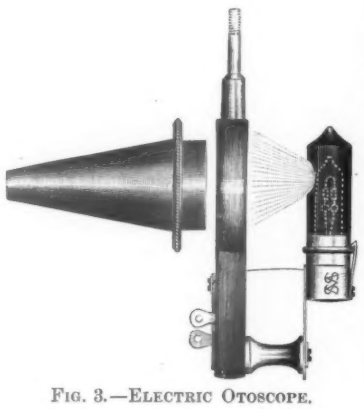


FIG. 3.—ELECTRIC OTOSCOPE.

although there are unmistakable symptoms of serious pathological disturbance, careful examination with the appliances heretofore in vogue fails to discover the exact location of the trouble.

This apparatus will also be found very useful in the operating room in other directions.

Beside its use in dentistry, the lamp will find extended application in general medicine

FIG. 5.—DUTO ELECTRIC CAUTERY.

and surgery, as an illuminator for the examination of interior cavities of the body.

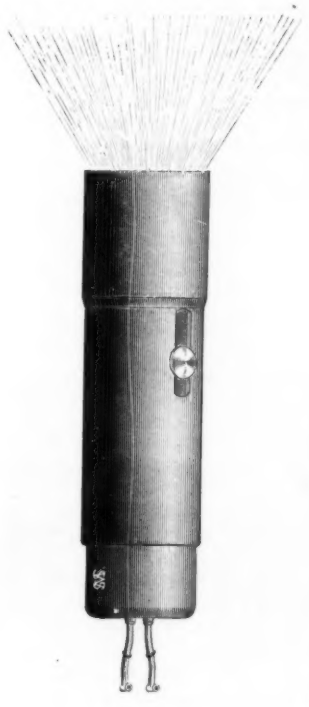
In use the lamp is placed behind the object to be illuminated—that is, so that the object is interposed between the lamp and the eye of the observer.

BATTERY POWER.

It has been found impossible, so far, to make the lamps of exactly equal power, but the variation is not great. To develop their full capacity requires about 3½ to 5 volts—say, the current from three cells of a Bunsen battery. The cells of the battery supplied with the electro-magnetic mallet are excellent for the purpose, or three cells of any bichromate battery will answer.

DESCRIPTION OF THE MOUTH LAMP.

The lamp *E* is an incandescent electric light, mounted permanently in a non-conducting case or cylinder of hard rubber. The lamp is supplied with metal conductors, which pass outside of the section of the case. The lamp case is carried in another hard-rubber cylinder, *D*, called the lamp-holder, which is also supplied with metal conductors fitting those on the lamp-case, the two parts, when adjusted, being clamped together by the set screw, *F*, thus holding the lamp firmly in its socket. The conductors of the lamp-holder are connected to the handle, *A*, by hinged joints, so that almost any desired adjustment is readily secured. This handle is called a resistance handle because it is wrapped with wire of a low conducting



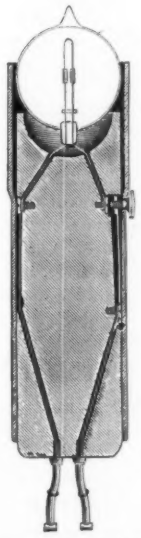


FIG. 6.—ELECTRIC LANTERN.

power, by which, through the agency of the ring, *I*, the flow of the current is regulated. When the ring is placed at the end of the handle nearest to the battery cord, the resistance is reduced to the minimum, and the current from the battery flows freely to the lamp. Sliding the ring to the opposite end of the handle compels the current to travel through the wire with which the handle is wrapped to the ring and back again, thus forming a resistance. The connection to the battery cord, *P*, is made by the spring coupling, *C*. A non-conducting guard or shield, *G*, is placed over the lamp globe for the double purpose of preventing the radiation of heat, and of directing the light to any point desired. At *H* is a screw for breaking the circuit. The circuit should be broken occasionally during a prolonged examination, and also whenever the lamp is not in use, to prevent its becoming so hot as to be unbearable in the mouth.

For the examination of posterior cavities in teeth a mirror, set at an angle of 45 degrees, is attached to the end of the guard. With the mirror attachment the electric mouth-lamp forms a perfect laryngoscope.

FIG. 2.—CARBON CELL BATTERY.

The carbon cell battery, Fig. 2, was designed to run the electric dental illuminator and laryngoscope, the otoscope and Duto electric cautery. It is small and compact and easily kept in order, the case, when closed, measuring 8 inches square by 8½ deep, and is exactly adapted for the uses named, which require a portable battery. The cells are of carbon, made impervious to moisture, and zinc for the anode. A hard-rubber cell is placed in the center of the battery box to place the zincs in when not in use. This vessel is filled with water and a small portion of mercury to preserve the zincs.

ELECTRIC OTOSCOPE.

The hard-rubber speculum, Figs. 3 and 4, is placed in the ear, with the conducting wires attached. The small incandescent

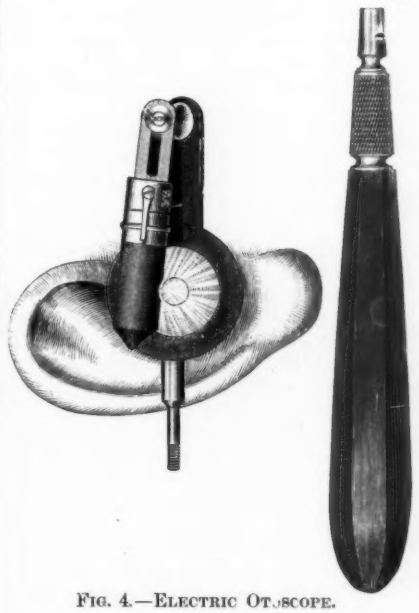


FIG. 4.—ELECTRIC OTOSCOPE.

lamp is so arranged as to throw the light through the speculum upon the part to be illuminated, at the same time giving free access to the parts to be operated upon. The guard is made adjustable around the lamp, so that the operator can direct the light to any spot desired.

FIG 5.—THE DUTO ELECTRIC CAUTERY.

Fig. 5.—This instrument is intended to be used as an obtunder of sensitive duction. It is composed of a hard-rubber handle, having conductors running through it, and terminating at the front end in a platinum loop, *A*, which is held in place by set screws, *B*. The front end of the rubber portion carries a flat spring. *D*, which makes and breaks the circuit.

The conducting wires from the battery are coupled to the terminals at *C*, and when attached to the battery and held in the hand, with the fore-finger closing the circuit, by pressing the spring, *C*, the platinum loop is at once heated.

The value of such an instrument is set forth in the accompanying note.

FIG. 6.—THE ELECTRIC LANTERN.

The electric lantern, Fig. 6, was originally designed by Mr. W. Waters, of New York, for reading astronomical instruments in his observatory. As modified to adapt it to their needs, it will be found very useful by dental practitioners to supply light for operating on dark days, and by the surgeon when a strong light is desired for the examination of the throat. The light is supplied by an Edison five-candle lamp run by the six-cell carbon cell battery. The sectional cut shows its construction nicely.

Reckenzaun's Electric Tramcar.

On Tuesday last, the first public trial of this car took place on the lines of the South London Tramway Company. The object of the trial was to afford the members of the Battersea Vestry an opportunity of judging of the practicability of this system of working tramcars. It will be remembered by our readers that Reckenzaun's system of propelling cars includes the use of accumulators placed on trays under the seats, and of two motors of specially light construction, placed on bogies under the car. The trays run on rollers, which greatly facilitates the changing of the accumulators, an operation which has to be performed about every two hours, when the car is worked to its full carrying capacity. There are 60 cells arranged in two rows of 30, and connected all in series. The current from these cells is led through a switch of special design, which enables the driver to put either motor into circuit alone, or both in series, or both parallel, thus providing a means for regulating the speed and tractive force according to requirements. All these operations are performed by one lever. The reversing gear is worked by another lever, which is set at the beginning of a run, but not touched during the run unless it be necessary to back on to a siding, and the current can be switched on and off by a third lever, which can also be left on during the whole time of a run. The driver has, therefore, only the lever for varying the power and the usual brake to look after. It is intended to add an electro-magnetic brake, which will automatically come into action when the speed of the car from any cause whatever should reach 15 miles an hour. Each end of the car is provided with the controlling apparatus just described.

The weight of the car is 2½ tons, that of the accumulators 1¼ tons, and the two motors, with reversing and controlling gear, weigh just under 10½ cwt. At the trial on Tuesday last, which we witnessed, the car was taken out of the depot at 3 o'clock, and was run westward along Battersea Park road, meeting on its way a strong contingent of vestrymen, who were taken on board, filling the car to overflowing. Thus loaded it was run up the heavy hill in Battersea Park road, and everything went well until, on the return journey, through the shaking loose of a nut between the terminals of two cells, the current was broken, and the car stopped for a few minutes. After making the connection good again, the journey was continued up Victoria road as far as Chelsea Bridge, and then back to the depot. Just outside the depot another mishap occurred (but this time not electrical), on account of a bad facing-point not being properly set over the car left the rails. The front bogie was ultimately got back on to the rails by running the car backwards and forwards over the paving, but owing to a sharp curve at that spot the hind bogie could not be persuaded to take the rails again until a straight piece of road within the shed was reached. Thus the last part of the journey was performed under as unfavorable conditions as could well be imagined, and it speaks well for the Reckenzaun motor and gear that the car could be brought home by its own store of electrical power with the hind wheels bumping over the paving stones. Although the trial did not come off as smoothly as the advocates of electrical propulsion might have desired, it nevertheless proved that the scheme of working the tramcar by accumulators is perfectly feasible and practicable, and we congratulate Mr. Reckenzaun on the success already attained. There are certain matters of detail which will have to be looked after, especially a proper connection between the electrodes of the accumulators to prevent them from being loosened by the jolting of the car; and we would suggest that the lugs of all the thirty cells on one side should be soldered together and not screwed up; or, if screwing be necessary, that lock nuts be employed. The accumulators, the motors, and the gear have been supplied and fitted up by the Electric Power Storage Company, of Millwall.—*London Engineering.*

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NEW YORK, APRIL 25, 1885.

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The cheap telegraphic rates between this city and Chicago have caused many prominent firms with houses in both cities to make use of the wires for all correspondence. The Western Electric Company are sending 200 words a day, and many other companies are making use of the same medium in place of correspondence in such proportion as their business may demand.

The Troy, N. Y., Electric Light Company have received the contract for furnishing the city with 100 or more lights. The award was made after the gas companies had exhausted their usual virulent opposition, and leaves the Troyites happy over the prospect of inhabiting a city with well lighted streets.

The importance of any invention which obviates the difficulties arising from "static charge" and "induction" in telegraphy is plain to every electrician, and the value of an invention which increases the business capacity of the telegraph lines of the country (the construction of which has cost many millions of dollars), will be obvious to those engaged in the telegraph business. On page 7 will be found a description of Thompson's condenser for telegraph circuits.

THE MOLECULAR SUIT.

The latest addition to what seems destined to be a very voluminous library, concerning telephone litigation, is the argument of Mr. Dickerson, counsel for the American Bell Telephone Company, in the suit of that corporation against the Molecular Telephone Company for infringement, before the United States District Court in this city.

Mr. Dickerson is a breezy lawyer, sharp and incisive in his language, and not a little given to satire, and his argument in this case is what Horace Greeley used to call "mighty interesting reading." He is always good-natured, and at the same time terribly severe at times, and his manner is of that aggravating kind which disturbs and annoys his opponents, and at the same time affords great amusement and entertainment to his hearers.

The argument is very elaborate, covering over one hundred and twenty closely-printed pages, and includes many extracts from the evidence, of which it is a complete review from the complainants' standpoint. The endeavor is to show that the instruments used by the Molecular Company are in reality infringements upon the patents of the Bell Company, and also that the Reis instruments, upon whose alleged performances in the past the defendants largely founded their case, would not, and could not accomplish that which the Bell instruments have actually accomplished from the start—transmit articulate speech. In the course of this argument, Mr. Dickerson shows from the evidence that Mr. Reis himself spoke of the apparatus as a "singing" instrument rather than a talking instrument, and, what is certainly a strong point, that Prof. Henry, who had a Reis instrument in his possession, was familiar with it, had tested it and experimented with it, declared the Bell telephone to be a wonderful discovery. Now, if as is claimed, the Reis instrument would do just what the Bell instrument did do, it is certain that Prof. Henry would have been aware of it, for he was as eminent as any electrician of his time, and was keenly alive to the need of an instrument which could and would do just what is now claimed for the Reis instrument, and if he had any such knowledge concerning this instrument, which was in his possession, he would have seen no novelty, no discovery in the instruments of Prof. Bell.

Reis always spoke of and described his instrument as one in which the vibrations of the diaphragm caused a make and break in the circuit, and the fact that his instruments were always so adjusted that the circuit was made and broken when the vibrations of the diaphragm reached a certain amplitude. His idea, expressed over and over again, was that the making and breaking of the circuit was an essential thing—in fact, *the* essential thing,—whereas, in the successful telephone, as used to-day, the one essential thing is that the contact between the electrodes, though variable, shall never, even for an instant, be broken, for if it be broken the talking instantly ceases. Had Reis so adjusted his instruments that there could be no break in the continuity of his circuit, no absolute break, but a variation, so that the resistance would increase and decrease with the vibrations, he would certainly have been on the road to a great discovery. But, as a matter of fact he did not, and it certainly seems to be proved that until Bell set up his theory of a *continuous* vibratory current, whose vibrations were caused and regulated by the action of the human voice, no such thing as the electrical transmission of human speech ever actually took place. Tones were transmitted, and, occasionally, when the instrument was handled "gingerly,"—that is, when the instrument accidentally got *out* of adjustment, as Reis understood it, but actually *into* adjustment, a word or a part of a word would seem to be recognized, especially if it were a part of a song, and the listener knew from the air what word to expect. It certainly seems fatal to the Reis claim that he insisted upon the very thing which, in telephonic apparatus, is fatal to the transmission of speech.

It is often said, by way of criticism of Professor Bell, that when he applied for a patent he had never actually constructed or tested the specific instrument described in his patent. Mr. Dickerson's reply to this is of special interest, and we quote it in full:

"Now, may it please your honor, a word on what my learned friend says about the progress of the Bell invention. He tells your honor that Bell never heard his telephone *talk* until after he got his patent. That is strictly true. He never heard his telephone *talk* until after he got his patent, and that fact demonstrates in the most striking manner the thoroughly scientific nature of the investigation, and the thoroughly scientific result which he reached. How? There is not one patent in a hundred, as your honor knows, in which the inventor has ever made his machine and tried it before making his application. He invents it; he sees with the eye of knowledge that it will work; he puts it on paper and takes a patent for it. If he is mistaken in his theory—if it will not work—he has not made the invention. If he is not mistaken, and it will work, he has made the invention; and the law does not require him to have first made it and put it into practical use, if he communicates to the public by his patent the description of his principle of action, which will, in the hands of skilled workmen, produce the proposed result. Some inventions are empirical—obtained by mere experiment. This was purely scientific. Professor Bell saw with the eye of science that he had made a great discovery, and *knew* that it was certain. He tried some experiments and got some noise, and that convinced him of the capacity of the thing to transmit *sound*, which was the only doubtful thing he had to solve by trial. That it must necessarily transmit the *form* of the sound he knew as well before he heard it as ever he could know it. He was master of the subject."

In the course of the litigation concerning the telephone that has been going on for several years, it has been said over and over again that the case of the Bell Company in the matter of priority of invention by Prof. Bell had never been gone into on its merits, and that when the opportunity came to state and prove *the facts*, as it must in the molecular suit, it would be seen that the Bell case was a very weak one. Certainly, the molecular suit has been tried, and every opportunity has been afforded to put in all the evidence there is touching prior inventions. As we see it, the Bell case is far from "weak." We do not presume to judge what the result is to be, but if it be in favor of the molecular it will be because its position is phenomenally strong, in the opinion of the judge—not because the Bell case is weak. We fail to see where the molecular has been successful in establishing its claim that its instruments work in such a way as to evade the Bell patents as they stand, nor that they have proved inventions prior to Bell's, and it does seem to us that every endeavor of the defendants to hold either the one or the other of these positions has been successfully met and combatted by Mr. Dickerson in his argument, only a small portion of which has it been possible for us to even refer to.

LEGISLATION AGAINST NATURE'S LAWS.

It is a much to be regretted fact that nature's laws can neither be revoked nor reversed even by a unanimous vote of both houses of a legislature with the seal of the State and the signature of the Governor thrown in. If this were not the case there is reason to believe the New York legislature would have had water running up hill long ago, and possibly have forbidden the planets to revolve round the sun or the satellites round their primaries.

Electricians are agreed that the telegraph will not work efficiently underground and the telephone is rendered absolutely uncertain by reason of induction and retardation. But neither induction nor retardation has terrors for the New York legislature. To the really great legal intellect such as these are small matters. The legislature has decreed that the telegraph and telephone wires must work underground and of course all such obstacles as induction and retardation will at once disappear and we shall know them no more.

The Board of Health too, has decided that the tearing up of the streets, especially at this time when New York is threatened with Asiatic cholera, would be suicidal and add terrors even to that grewsome scourge. But the trouble with the Board of Health is that they understand the subject upon which they essay to speak, and that, in the eyes of the New York legislators, is against them. In the opinion of these gentlemen no one is capable of deciding questions with which they are familiar. Thus when they wish to make an official inquiry as to whether the city of New York is well paved, they send down a committee made up entirely of members from the farming districts who never saw any pavements, and are uncertain whether the word "pavements" means a peculiar kind of cattle, or a new discovery in the mixed drinks line.

Seriously speaking, the general public has for long been hoping for a reduction of rates in the city of New York, and were in a fair way to obtain what they wanted, when the Legislature stepped in and thought to help them to cheap rates by making the companies bury their wires, and thus increase the cost of service.

The absurdity of this move on the part of the Legislature is so apparent as to need no further comment, but its injustice can only be understood by explaining what are the rights the companies possess—for even telegraph and telephone companies have rights.

It will be remembered that Mr. Cleveland, when Governor, refused to sign the "Five Cent Fare Bill" despite the howling of an unthinking public, and the wails of an overzealous press, for the reason, as given, that the State having given the elevated roads certain privileges to encourage capitalists to risk their money, could not legally or justly withhold or curtail those privileges because the scheme had proved successful. Now for the same reasons it can be shown equally illegal and unjust to give the electrical companies the right to string their wires through the streets, and when they have expended their money in good faith and try to get it back in the legitimate way, suddenly turn upon them and refuse to carry out the bargain, and it is difficult to understand how Mr. Cleveland could have lent himself to such a sorry piece of business as the signing of this bill after he had admitted the soundness of the principle of charter rights in the case of the elevated roads.

But the worst feature of the bill that forces the companies to bury their wires is, that by reason of certain phenomena already explained, they will not work efficiently underground.

OVERHEAD WIRES.

It is not surprising to see papers of which it may be said that mis-information is the breath of their nostrils, continually asserting and reasserting that in European cities all electric wires of every description are placed under ground, and that therefore there is no good reason why the same thing should not be done in this country. Such papers take no pains to ascertain the facts; they simply repeat, parrot-like, what they have read in the columns of their exchanges, and upon these statements build flimsy structures which it pleases them to style their editorial opinions. But we must confess that we had expected better things of the Springfield *Republican*, the paper whose proud boast it is that it "Gives the news and tells the truth about it." We do not accuse it of any inten

tional lapse from this high and meritorious standard, but it does seem as though he who ventures to take such high ground should at least be certain that he is informed before he presumes to speak.

Now, the simple fact is, that there is in all Europe—in all the world, in fact—one, and only one, city in which it can be said that the wires are even *generally* under ground. That city is Paris. It possesses a magnificent system of immense sewers, large enough not only to carry off the sewage of the great city, but also to carry water and gas pipes, and even, in emergencies—and it was partly for this that they were made so large—to move troops from one portion of the city to another. They are in reality subterranean streets, many of them provided with tramways, upon which men and materials are carried from one place to another when repairs or changes are required. These sewers were constructed in flush times, when the Second Empire was in full feather, when the public money was spent like water, and the people were taxed inordinately that the Government might keep the working classes from discontent by giving them employment on public works. It is in these sewers, built for a far different purpose, that the electric wires of Paris are mainly placed, although there are some few of the telegraphic sort which are actually buried in the ground, and also some few in the air.

In London there is no general system for putting wires under ground. There are a few "subways," and where these exist they are in use. But the great bulk of the wires in London are overhead, just as they are in this country, and no one can read the English papers without seeing comments on the subject which clearly show that this is the case. In the other cities of Great Britain and Ireland the wires are all, practically, overhead, in the same sense that here in New York they are practically all overhead, albeit there are probably a thousand miles of buried conductors in this city and Brooklyn for telephonic and telegraphic purposes. In France there are some buried telegraphic wires outside Paris, and the same may be said of Germany, but these are Government lines, built without regard to cost, and the reason for burying them is chiefly a military one.

We must confess our surprise that the various electrical companies have not been at pains to refute explicitly, on the basis of an exact statement of the facts in the case, this assertion which has been so broadly made, and is so generally believed in this country, that overhead wires are practically unknown on the other side of the ocean. It is true that there are not so many wires, but this arises from the fact that neither the telephone or the telegraph is used by the public in foreign countries with anything approaching the frequency with which it is used in America. Then, again, other appliances, in regular use here, are almost unknown on the other side. There are no "gold and stock" circuits, no district telegraph service to speak of, and no burglar alarm wires. Again, the telegraph being a Government monopoly, there is no telegraphic competition, and no multiplication of wires in that service. Hence there are far fewer wires in the aggregate; but, with the exception of Paris, where the sewers offered an opportunity not to be neglected, and measurably no other cities possessing subways, the electric wires in Europe may be said to be almost wholly overhead wires, with the same exceptions that obtain in this country.

The statement current recently that the electrical companies in New York defiantly refuse to comply with the law of the State, which requires all wires in New York and Brooklyn to be placed under ground before the first day of next November may be technically true; but, if so, it is also to be said that New York and Brooklyn are themselves in the same defiant attitude. The law requires that their wires, used for police and fire alarm purposes, shall also go under ground, but we see no disposition on their part to make a move in the matter, although we do see a constant willingness on their part to use the poles and fixtures of the electrical companies for supporting their wires. Until they get ready to act, corporations can hardly be expected to do more than has been done, and certainly the Western Union Telegraph Company and the telephone companies in New York and Brooklyn have undertaken and done some very serious and very expensive underground work. So far as it has gone, we have reason to suppose that it is giving good satisfaction, but in the aggregate it is but a drop in the bucket compared with the whole number of wires in use in the city.

The Daly Bill, the law referred to, is a loosely and clumsily-drawn statute; many of its provisions are obscure as to their meaning; and, strictly construed, it demands impossible things. That the Legislature is tinkering it again this year is a confession of this. When it again emerges we shall be able to judge somewhat of its merits and probable efficacy. This much is certain. If it seeks to sweep all wires from poles and to put all wires under ground, the result will be seriously to interfere with the business convenience of our citizens. Two-thirds of the telegraph offices in the city will be closed, and the cost of messages will increase. The district messenger and burglar alarm business will come to a full stop, and the telephone company will be compelled to cut off all of its subscribers in outlying districts of the city. We are not of the opinion that the public desires legislation that would inevitably produce just these results.

GENERAL WESTERN NEWS.

While arc lighting appears to have ordered a temporary halt hereabouts, the incandescent systems seem to be taking the lead, and plants of the latter forms are on the increase. Electric light systems, as a group, may be compared to an army of artillery and small-arms. In its advance against the common enemy, the public—it is fighting after the English fashion—conquering to civilize the enemy—it is sometimes necessary to use the one branch of the army while the other is at rest. Just now the small-arms division is manœuvring, while the heavy guns are only doing a little special bombarding here and there. The glitter of the infantry bayonets—glow lamps—now flashes from several of our better places of amusement, and shortly these will be nearly or quite all captured by this arm of the service. The new Chicago Opera House, which is to be ready for ticket-seller and door-tender late in the summer or early in the fall, is to be arrayed in the electric light dress; McVicker's is now being overhauled and wired; and several other places, which will be mentioned in due time, will shortly follow suit.

Why they cannot be mentioned now lies in the fact that the several companies have latterly become quite reticent of information; as they mildly put it, "We would like to be sure of our contracts, you know, before we say much." This is as true of the arc as of the incandescent systems, all of whom are watching chances, as a cat watches a mouse, for opportunity to pounce upon any one who, by an unguarded remark, becomes a "suspect" in the matter of even thinking about having an electric light; and the writer is asked the question repeatedly, "Where can I go to put in a plant?"

This country, following in the lead of the city, is asking more and better light. The committee on public charities—part of the Board of Commissioners of Cook Co.,—by the clerk, Jas. C. Strain, has asked proposals from the several electric light companies for illuminating the insane asylum and infirmary buildings at Norwood Park. No specifications are made, and only three days are allowed in which to make proposals. It will be a lively skirmish on the part of bidders to find out just what is wanted, and then get estimates out in so short a time. Only sharp scientific guess work can accomplish so much in so short a time.

A novelty in this line is the self-adjusting apparatus of Mr. Harold P. Brown, of Chicago, formerly with the Western Electric Company, and later of the Brush agency here.

Some little discussion has been going on lately, not only in Chicago, but elsewhere, relative to the use of the fusible metal strips in incandescent plants. The point at issue is where these should be placed to be most effective, and the claim has been made that one in the lamp socket of each lamp would effectually protect this lamp — *ergo*, the branch in which the lamp is placed.

This seems much like damming a stream to keep it from running up-hill. The danger on the branch is anywhere from the junction to the lamp, and the soft metal can only protect what is in advance of it, all behind being protected by the next plug in the direction of the dynamo. Putting the soft strip in the socket of the lamp, or, as has been done, in the inner bulb of the lamp where there are two, will protect the lamp, but will not protect the circuit; while, when placed at the junction of the branch and the next larger wire, the entire branch is protected, and each such subdivision of the circuit should be so protected.

Chicago is fast becoming cosmopolitan in the matter of incandescent as well as arc systems. No less than eight varieties of incandescent and a still larger number of arc systems are on the market, and more to come.

Next to dynamo and lamp invention in order of activity comes the regulators and measurers of current, and it is remarkable how many of these overlap each other when they arrive at the Patent Office.

Of course, a full description is impossible here, inasmuch as the Patent Office seal has not yet been affixed to all of Mr. Brown's papers, but parties who have examined and witnessed its operation consider it an excellent apparatus for the purpose, which is succinctly the automatic change of resistances in shunts in an incandescent system. In the experimental plant, which Mr. Brown is exhibiting, it certainly works well; but, like all electrical apparatus, must come out and show itself in practical results before it can be considered a thorough success. A full and complete examination by critical experts is to be had in a few days, when, unless some unforeseen developments make their appearance, it may be considered a good thing.

But, there are already several of these regulators, some of which have been through, and more are still in the Patent-office grist mill, that like Longfellow's mills of God, grind slowly; and the time has come when he who would patent an electrical invention is often

> "Illured by Hope's bright guiding star
> To disappointing dark despair."

Once there was a man who wanted his house painted. The painter looked wise, made some cabalistic marks with red clay on a shingle, said aloud "half of two is one, nought is a nought, figger's a figger. Do it for $45, and lose money on it, but I must have work." His prompt manner, according to the story, won the confidence of the house owner, and eventually made his fortune. He should have been an electric light man.

Most of us have been taught that in a bar or straight magnet there are two—and only two—poles. Like many another rule this has notable exceptions. An annular plate may have at least four polar nodes, and a steel wire several.

A very easy way of showing this is to polarize the balance spring of a watch. Being of fine steel it will receive and retain a very considerable amount of magnetism. Now, if carefully floated on a glass of water, it will show its polarity by setting in the magnetic meridian. A horse-shoe magnet brought in proximity to the outside of the glass will tend to make it revolve on its center, and by raising and lowering the magnet so as to present alternate polarities to the little coil, it may be made to make complete and rapid revolutions. If now the coil be straightened it will be found to have several north and south poles.

Wooley's locomotive head-lights are being experimented with by the Illinois Central Railway Company. Similar trials were made on the C. M. & St. P. R. last year between Chicago & Milwaukee. The officers of the Central say they intend carrying the test far enough to settle the headlight matter one way or the other, and will accept and use it if it proves itself worthy of adoption.

The fire insurance underwriters of Sweden have adopted regulations regulating the installations of electric light plants throughout the country. In one or two particulars these rules differ from those most in vogue elsewhere.

The transverse section of any arc light wire shall be no less than a square millimeter for each two amperes of current. For incandescent circuits 3 amperes per square millimeter for intensities of 50 amperes, 2.5 amperes per square millimeter for 100 amperes, 2 amperes per do. for 300 amperes, and proportionately for higher intensities. In arc lamp circuits the + and — wires shall have a separative distance of 50 millimeters for 120 volts, which distance must be increased 25 millimeters for each augmentation of 60 volts, until the maximum, 300 millimeters is reached, and in incandescent systems the conductors must be at least 50 mm. apart.

Naked wires are permitted over house tops and through the streets, but these must be separated by five times the distance required for insulated lines as above. Inside wires must be thoroughly insulated, all joints soldered, or solidly joined by connectors, and where passing through walls, floors, partitions, etc., ebonite or glass must be used as insulators. The item relative to incandescent lamps which requires that these shall be *inclosed in strong glass globes*, "particularly in places where there are explosive materials, and where the atmosphere may become charged with gas," is a master stroke of wisdom that only the cold, calculating northern blood could be guilty of! The whole country might have been ruined if Swan, or Edison, or Maxim, or some other glow-lamp fellow had sneaked up a line of incandescent lamps without poles, and thus committed wholesale incendiarism; or supposing they had put them in strong tin or sheet-iron globes, how dark, how dismal, how universally desolate, and dreary and dangerous would have been the result!

While the Missouri and Kansas, the United and Great Southern and other telephone companies hereaway have again passed the quarterly pay day, the Chicago Company declared its usual 3 per cent., the Wisconsin Company 2 per cent., and the Central Union 1¼ per cent. for the quarter ending March 31st.

There is no copper conductor No. 74 extensively used out this way, and the compositor who put one in a Patterson cable, instead of No. 14, should look well to his honors as an electrician.

Col. R. C. Clowry, general superintendent of the central division of the Western Union, Chicago, has been elected president of the Central Union, vice General Anson Stager, deceased.

The Telegraphers Benevolent' Association of the United New Jersey Division of the Pennsylvania Railroad held their annual meeting at the company's building on Clinton Street in Trenton, N.J., last week. About 100 members were present. The following officers were elected for the ensuing year: W. Ettenger, President; G. N. Gregg, Vice-President; Frank Scott, Secretary and Treasurer; E. P. Bruere, G. A. Cliver, J. E. Stevenson, H. L. Husted, W. H. Everson, Executive Committee; W. T. Swem, S. H. Hubbard, M. F. Tomlinson, Auditing Committee.

A very interesting article on the laws of magnetic attraction, by Professor Van der Weyde, will be found on page 2 of this edition.

Telephonic News

*** The Kansas City telephone exchange added sixty one subscribers to their list in March.

*** The telephone exchanges in Kansas are losing some subscribers by the closing of the saloons under the new prohibitory law.

*** The Indiana legislature has passed a bill preventing discrimination by telephone companies. This was procured by the competitors of the Western Union They have also passed a bill fixing telephone rentals at $3 per month, which awaits the Governor's signature.

*** A small telephone exchange is being constructed at Marietta, Ga., twenty miles north of Atlanta—the two cities to be connected by trunk lines. Long-distance telephoning has not come into much use in the South as yet, but the demand for it is gradually increasing.

*** The Missouri and Kansas telephone people, by keeping a close watch for "bugs" on their extra territorial lines, and by the adoption of a uniform system of passing calls, to save time, have increased their receipts on the two wires out of Kansas City, from $774 in October last, just before the change was made, to $1,071 in March, being an increase of 38 per cent.

*** The Continental and Tropical Telephone companies have sold the following telephones for export:

To Brazil.....	2,613	sets of	telephones.
" Buenos Ayres.	2,483	"	"
" Mexico.....	3,197	"	"
" Venezuela....	635	"	"
" Cuba.....	592	"	"
" West Indies..	488	"	"
" West Coast So. America.	911	"	"
" Spain.....	292	"	"
" Cent'l America	153	"	"
" U. S. of Columbia.....	222	"	"
	11,586	sets of	instruments.

Besides the other patented auxiliary instruments, apparatus and supplies, all of American Bell Telephone Company's manufacture.

*** The annual report of General Manager Guiraud, of the Mexican Telephone Company shows the receipts from rentals for the year ending, March 31st, 1885, to have been $29,451.56 against $20,947.94 for the previous year; an increase of $8,503.62. The expenses have been greatly reduced, amounting to $29,909.17 against $51,944.01 for the previous year; a decrease of $22,034.84. The connections made during the year were 269 in this city, and disconnections, 167; a net gain of 102. The number of subscribers on March 16th was 586. A profit of $3,055.27 has been made on the sale of supplies. The company's expenses are greatly reduced by the contract made June 18th, 1884, with the Department of Public Works, whereby in virtue of certain considerations, all the company's material is imported free of duties, thus saving 55 per cent. on the value. During the last year the poles have been entirely changed, new and better ones having been planted in place of the old ones which were rotting badly, and many of them ready to fall. In the face of this extra expense the decrease of over 40 per cent. in total expenses as compared with those of the year before is remarkable, and does credit to the management. The office at Guadalajara is established on a paying basis with net monthly earnings of about $130, calculated on the basis of February earnings and expenses. Superintendent Hobart reports all lines in good order, and calculates that construction expenses for the next year may be safely estimated at one half of the amount expended this year, and that costs of operating will be reduced one third. On the whole, the report augurs well for the future success of the telephone business in Mexico, and shows the effect of wise and economical management during the past year.

*** The Kimball House, Atlanta, Ga., is having placed in the corridor of each of the seven floors a telephone for the use of the guests, saving them a trip to the office when they desire to communicate with city points. All the stores on the street floor of the hotel use telephones, the demand being so great that a cable containing twenty wires comes direct to the building from the Central Telephone Exchange.

*** Messrs. Brownlee & Co., of Detroit, Mich., have recently invented some very ingenious machinery for the manufacture of insulator pins, cross-arms and brackets, which they are now using in their factory. Their pin machines are automatic, and turn out pins that are perfectly uniform. The thread on the pins and brackets is always exactly the same size and pitch. This will be appreciated by line builders, as ordinary pins vary greatly in size, some being too large, and others too small to fit the insulators.

Messrs. Brownlee & Company have also invented a bracket that is a great improvement on the old style. They are concaved on the inside so as to fit closely without dressing the poles. These brackets can be attached much quicker, and are much firmer when attached, than the old style. The saving in time of putting them up is nearly enough to pay for the brackets.

In the manufacture of cross-arms they have an advantage over their competitors, not only in the improved machinery used by them, but they cut the pine from their own lands, thus getting their material at cost. Messrs. B. & Co. are also extensive dealers in cedar telegraph poles, in which business they have been engaged for 15 years.

A New Magneto Bell.

The following cut illustrates a new magneto bell now being manufactured by the Railway Telegraph Supply Co., of Chicago. The cut gives the bell the appearance of those in common use, but in its action the bell is entirely different. In placing the hand telephone into the yoke, the same as in the ordinary bell, the sides of the yoke are pressed apart and this action, by means of a unique interior arrangement, throws the bell in circuit and cuts out the battery, accomplishing the same end attained by the gravity switch, but not by gravitation, as will readily be seen. The bell is covered by patents owned by the above named company, and is fully warranted. Mr. M. A. Knapp, the enterprising general manager of the company, is receiving flattering testimonials of the successful working of this bell, and has already secured a large trade among Western dealers. The company's office and factory are in Chicago, corner Fulton and Union streets.

MAGNETO BELL.

The Supreme Court of Minnesota holds that the notice on Western Union blanks, stipulating with the sender of a message that all claims for damage, to be valid, must be presented in writing thirty days after its dispatch, is a reasonable one, and that the sender is bound by it as a part of his contract. It is not a regulation intended to shield the company from the consequences of neglect of duty, but prescribes a duty to be performed by the sender before he can be entitled to maintain his action against the company. By means of such timely notice, the company can ascertain the facts in the case and secure or preserve the evidence in regard to it. If claims could be brought at any time, the door would be opened to many attempts at fleecing the company. On broad grounds, the decision is proper.

The B. & O. Telegraph Ask a Mandamus Against a Telephone Company.

The Baltimore & Ohio Telegraph Company, by John K. Cowen and E. J. D. Cross, attorneys, field a petition in the Superior Court on Saturday, asking for a mandamus to compel the Chesapeake & Potomac Telephone Company to place a telephone instrument in the central office of the Baltimore & Ohio Company, at the corner of Baltimore and Calvert streets, and to connect it with the exchange for the delivery and receipt of messages and dispatches. Judge Phelps passed an order requiring the Chesapeake & Potomac Company to show cause on or before April 25, 1885, why the mandamus should not issue as prayed.

The petition of the Baltimore & Ohio Telegraph Company of Baltimore City recites that since its incorporation, on Jan. 7, 1882, it has been extensively engaged in the business of receiving and transmitting telegraph messages for commercial purposes, and in connection with other companies in different States of the United States; that its business extends over twenty-eight States, and also, by contracts with the ocean cables, to Europe; that it has 1,531 offices in the United States. The Chesapeake & Potomac Telephone Company of Baltimore City has been in existence for some period of time, and has its principal office and place of business in Baltimore; that, under its charter as a telegraph company, it has been carrying on the business of sending and receiving messages only by telephone, which the petitioner is advised is within the corporate powers of the defendant, and that the defendant does not carry on a telegraph business, but a telephone business exclusively. The petitioner states that the defendant has established an exchange in the city of Baltimore from which connections are made to telephone instruments in the offices and places of business and residences of its subscribers, who are a great majority of the business houses and firms in the city of Baltimore. The petitioner states that by virtue of the act by which the defendant is a corporation it is its duty to "receive dispatches from and for other telegraph lines, associations and companies, and from any individual, and shall transmit such dispatches in the manner established by the rules and regulations of such telegraph lines, and in the order in which they are received, with impartiality and good faith, under a penalty of $100 for every neglect and refusal to do so;" that by chapter 360 of the acts of the General Assembly of 1884, it was enacted that telephone companies, as such, could be incorporated under the provisions of the general incorporation laws, and that all the provisions of the general laws in relation to telegraph companies should likewise apply to telephone companies.

The Baltimore & Ohio Telegraph Company states that the exigencies of business and the demand for speedy communication for commercial and other purposes render the use of telephones a necessity in all kinds of business; that the Baltimore & Ohio Company, in the collection of messages for its corporate purposes and in the distribution thereof in the city of Baltimore, requires the use of the instruments and connection with the exchange of the Chesapeake & Potomac Telephone Company; that it is the corporate duty of the Chesapeake & Potomac Telephone Company to supply facilities impartially to all persons applying for them who will pay for the use thereof; that the defendant has assumed the responsibility of a common carrier of news, and that its operation is a necessary supplement to the telegraphic business of the country; that the petitioner, desiring the use of the telephone services of the defendant and connection with its exchange with the business of the community of Baltimore city, for its purpose of receiving and delivering telegraphic messages, and especially for speedy communication with the various city offices of the Baltimore & Ohio Company, on or about December 4, 1884, applied to the Chesapeake & Potomac Company for the introduction of its telephone, to be placed in the telegraph department of the Baltimore & Ohio Telegraph Company in the Central Building of the Baltimore & Ohio Railroad Company, corner of Baltimore and Calvert streets, and for a connection with the central exchange of the defendant; that Charles Selden, superintendent of the Baltimore & Ohio Telegraph, had an interview with Archibald Wilson, superintendent of the Chesapeake & Potomac Telephone Company, who stated that the only terms upon which the instrument would be placed in the Baltimore & Ohio office would be upon a contract for the Baltimore & Ohio not to use the instrument for the purpose of collecting or transmitting or delivering any message for which the Baltimore & Ohio would demand compensation.

The Baltimore & Ohio Telegraph Company further states, upon information and belief, that the Chesapeake & Potomac Telephone Company has placed in the offices of the Western Union Telegraph Company in Baltimore certain of its telephones and connected them with the central exchange, and the Western Union is engaged in the same business as the petitioner and is a competitor therewith, and the petitioner avers that the defendant has denied and does deny a like use of its telephones to the petitioner, and the defendant claims that it has the right to deny the use to the petitioner, and claims to have the right to make a contract for the exclusive use thereof with the Western Union Company of Baltimore City, but the petitioner is advised that the contracts are void, as against public policy and in violation of the corporate duties of the defendant. The defendant has refused and neglected to place a telephone in the office of the petitioner, although the petitioner is ready and willing to pay for the same, and to execute a reasonable contract for the use thereof, and to comply with the reasonable regulations for the conduct of business. The petitioner charges that the reason for the refusal of the instrument is because the petitioner designs to use the same in connection with its business of receiving, transmitting and delivering telegraph messages. The petitioner therefore prays that a writ of mandamus may be issued, directed to the Chesapeake & Potomac Telephone Company of Baltimore City, commanding it to place a telephone instrument in the office of the petitioner, and that the same may be connected with the exchange, and that messages and dispatches to the petitioner from parties connected with the exchange, and messages and dispatches from the petitioner to said parties may be received and transmitted in good faith and with impartiality.

Aerial Conduits for Electrical Wires.

A system of aerial conduits for electrical wires has been invented by Mr. D. B. Macquarrie, manager of the Missouri & Kansas Telephone Company, Kansas City, Mo., which consists principally in supporting upon posts, or columns, a continuous chamber in which the wires are confined. The object of the inventor has been to provide a system that will overcome the defects of the underground conduits and avoid the necessity of the many large poles at present demanded in all cities. In construction a line of supporting posts is provided with suitable flanges at their bases and secured to a foundation of masonry. They may be of any suitable material and tamped in the ground as ordinary posts are, but preferably, are formed of cast-iron with a flange at each end. The flange at the upper end projects sufficiently at either side of the conduit to form a support for the cover-sections when removed from their normal position. This arrangement obviates the necessity of lowering the cover to the ground when the wires are to be repaired. In the construction of the conduit, sheet-metal is given the preference. The chamber or conduit is rectangular in cross-section and is composed of a pair of side-sheets to the lower edge of which a flanged bottom sheet is securely riveted. Bracing-plates, perforated for the passage of the wires, are placed immediately over each supporting post and are used mainly to impart rigidity

to the sides of the conduit, to which they are securely riveted. The plates being perforated are utilized as wire supports, but as they are limited in number, intermediate devices for supporting the wires may be employed. Any of the improved devices now in use for the purpose can be used here.

The wires within the conduit are protected by removable weather-proof cover-sections having pendant side-flanges and tongued and grooved end-portions. The length of each cover-section corresponds to the distance between the centers of the supporting columns. After the wires have been placed in position, any desired section of the conducting chamber or the entire length thereof may be filled with paraffine, or other insulating compound, but this is not deemed essential to the perfect working of the line.

It is evident from this construction that telegraph and similar wires may be confined in a very limited space—for instance, a ten-inch conduit will accommodate two hundred wires, and their electrical condition and freedom from mutual interruption will, it is thought, be more perfect than in any known system.

The system affords protection to life and property, for, unlike the pole system, it will be impossible for a wire to break and fall from its position in the conduit, and will operate equally as well when constructed along the narrowest alley-way as upon the broadest streets—a fact of no small importance in the construction and maintenance of a telegraph system. With supports elevating the conduit about 30 feet from the surface, it will be high enough for any ordinary vehicle to pass under without being obstructed.

Cheap Telegrams.

The *Times* says that the English post-office will soon reduce by one-half the minimum charge for telegrams. It also proposes to change the system upon which the words in the message are counted. Inasmuch as the present system of counting is like our own, and as Mr. Shaw-Lefevre, in announcing the change, declared that it alone made the cheaper rate economically possible, his statement has an obvious bearing upon the telegraph business of the United States, apart from the general significance of his very interesting figures.

The present charge for telegrams in England is 1s., say 25 cents, for 20 words, address and signature both gratis It is arranged that after Aug. 1 the charge shall be 1d., about 2 cents, for every 2 words, and every word is to be counted; but no message will be sent under 6d. The change may seem slight, but as it concerns each of the 24,000,000 telegrams now sent it amounts to a revolution in the business. As cheaper telegrams here may result from the working of the reform, it is worth while to examine how the old plan works in detail and to learn what is expected of the new plan.

People being human, it is not surprising to learn that most of them use as nearly as convenient the entire 20 words permitted under the tariff, even when fewer would answer the purpose equally well. The average message number 17 words. But surely there is even less excuse for magnifying the addresses. The average on this head is 11, making the total message average 28. The cost of sending this is 10d., allowing no interest for the cost of the plant. Upon the whole investment the Government receives only 2½ per cent. if allowance be made for unusual expenses on capital account. Without such allowance there was an actual deficit of nearly $100,000. Clearly it was impossible to reduce the tariff unless the system as well as the rate could be changed.

Mr. Shaw-Lefevre stated that the department believed that verbose messages were no boon to the public, and were an unnecessary cost to the post-office. The same is true of extravagant addresses and signatures in even greater degree. Accordingly it was resolved to give users of the telegraph the option of economizing in the address and signature and receiving the benefit in a less charge for the text. Thus the words outside the body of the message could be reduced by nearly two-thirds, it being calculated that five words are enough to identify both the sender and receiver. This leaves seven words for conveying information without exceeding the minimum. That this will be sufficient, ordinarily, is the judgment of the officials, who estimate that over one-third of the messages which now average 28 words will go at the new rate of 12 cents for 12 words. An average increase of business of one-third is also expected, and a reduction of cost upon an average message to 8¾d. There is no apparent reason why anybody should expect any telegraphing for nothing, and there is no difference in cost of service whether a word be in the address, signature, or text. In ocean telegraphing, and throughout Continental Europe, every word is counted. After August only Americans will expect to get addresses telegraphed free of charge. If they were given the option of a briefer dispatch for less money they and the companies might both profit. The charge for plant being a constant one, every increase of business obviously increases the margin of profit.

Thompson's Condenser for Electric Circuits.

BY WHICH THE BUSINESS CAPACITY OF THE PRESENT TELEGRAPH WIRES OF THE COUNTRY MAY BE DOUBLED.

The extraordinary increase in the number of messages transmitted by telegraph during the past few years has brought prominently forward the problem as to the best way of meeting this increase in the future. Notwithstanding the great number of lines that have been constructed, the construction has not kept pace with the increase of business. Nearly all the railroads and post-roads have lines of poles on either side; and it is simply a question of time, when telegraph lineways, as distinct from railroads or post-roads will become necessary.

For the present, it is desirable to increase the capacity of the lines already constructed, by employing automatic, duplex, and quadruplex telegraph systems as far as practicable.

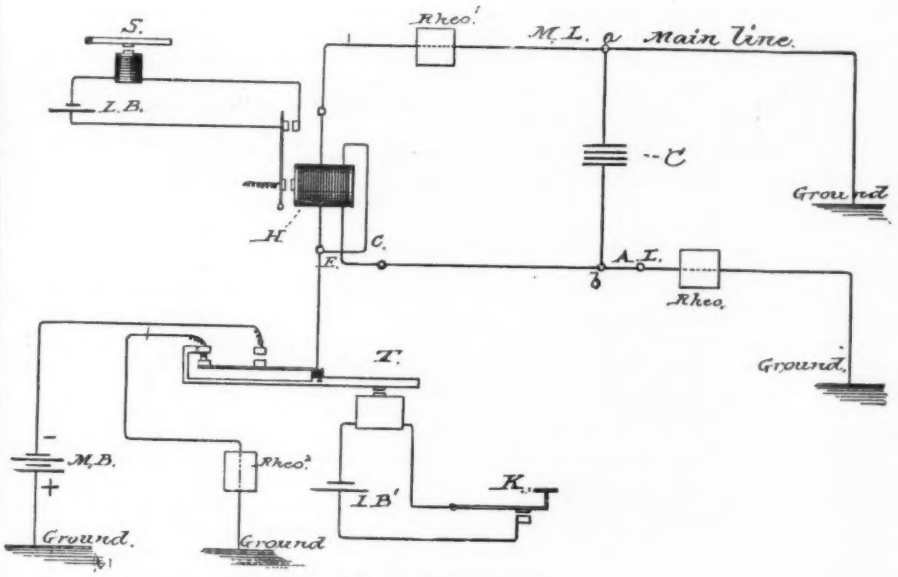
Owing to difficulties arising from induction between parallel wires, but a small proportion of the wires on a line of poles can be utilized for automatic, duplex, or quadruplex circuits, as these systems are operated at present.

An invention recently patented by Benjamin Thompson, of Brooklyn, N. Y., enables all the wires on a line of poles to be used as duplex, quadruplex, or automatic circuits. By this invention, the capacity of the lines for doing business is more than doubled, and at the same time, the operation of these systems of telegraphy is rendered more reliable. A saving of about twenty-five per cent. of the battery at present used, is effected, which would approximate a reduction of $100,000 per annum in battery expenses on the duplex and quadruplex circuits now in use in the United States.

Like all important inventions, Mr. Thompson's is extremely simple in its nature, and is easily understood and operated. The diagram shows the invention as applied to duplex telegraphy. The condenser, *C*, it will be noticed, is connected from the artificial line directly to the main line, the Rheo being placed in the main line for the purpose of creating a greater difference of potential between the points of connection of the condenser than would naturally exist without it. The potential of the current being higher in the artificial line than in the main line, the current will inductively pass from the artificial to the main line until the potential of the main line equals the artificial line; then no current will pass to the line through either of the coils of the relay, *H*. Thus the static charge to the line is neutralized. When the transmitter is opened, the discharge of the condenser will neutralize the discharge of the line, the line effect and the condenser effect upon the relay, *H*, being opposite the static discharge is thus eliminated.

The effects of induction from parallel wires do not disturb the receivers, as the induced currents divide, part going through the resistance, Rheo, and the live coil in one direction, and part going through the condenser and the other coil of the relay, *H*, in the opposite direction. Hence a neutral effect results.

The saving of battery is owing to the secondary effect of the condenser operating in conjunction with the main battery, which, for a moment increases its potential on the line and assists in overcoming the tension of the retractile spring of the armature. The armature being attracted, the main battery is then capable of holding it, as it is nearer the poles of the electro-magnet.



THOMPSON'S CONDENSER.

Several American telegraph operators have recently been offered good positions to go to Siam to work on the new telegraph lines of that country. The pay is $150 a month, with free outward transportation. The Siamese Government, after a careful study, decided to adopt the American telegraph alphabet and instruments rather than the continental or European method and pattern.

.... Estimates of the richest men in the world are said to be Mackay ($275,000,000), Rothschild (200,000,000), Vanderbilt (175,000,000), and the Duke of Westminster (80,000,000). "When we remember that poor Jay Gould has only $50,000,000," says the Utica *Observer*, "a depressing sense of the inequality of the distribution of wealth creeps ouer us."

TELEGRAPHIC

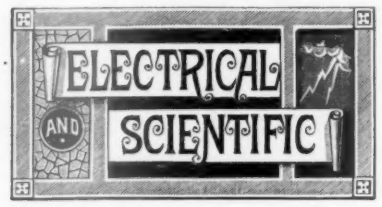
.... The Southern Kansas Railroad Company, who have an independent telegraph system, are to extend their wires into Kansas City, where they will connect with the Pacific Mutual. It is said the New Western Telegraph Company is also to connect with the Pacific Mutual.

.... Jinks—"Poor fellow! it will be a terrible blow. He knows nothing of the failure yet, does he?" Minks—"Not a word." Jinks—"Well, I certainly would keep it from him as long as possible" "Yes; I have arranged for that." "In what way?" "I have sent the news by a messenger boy."

.... In view of the proposed International Telegraphic Conference to be held at St. Petersburgh this year, a communication has been sent to the Postmaster-General of Great Britain, urging the necessity of obtaining some modifications in the present excessive and unequal rates charged for telegraphic messages between this and other countries. It is pointed out that while the rates for France are 2½d. per word and for Belgium 2d. per word, the rates for Germany and Holland are 3d., Norway 4d., Austria 4½d., Italy 5d., Sweden 5½d., and Russia 9d. per word. The inequality and unfairness of the rate is shown by the fact that a message of twenty words from England to Russia costs 15s., while one of similar length from Russia to England is four roubles, equivalent to 8s. only. The charges to Sweden and Norway are likewise excessive when compared with the rates to Germany and Holland.

.... Justice Peckham, in Chambers, last Saturday, at Albany, N. Y., granted an order making the decision of the Court of Appeals the judgment of the Supreme Court in the case of The People against the Western Union Telegraph Company. The action was to recover $131,818.66 tax, at the rate of one-quarter mill for each 1 per cent. of dividends declared on the capital stock. The Hon. Samuel Hand, to whom the case was referred, reported judgment in favor of the plaintiff for the amount claimed, with interest, making in all $178,397.26. The company appealed, but the judgment was affirmed by both the General Term and the Court of Appeals. Justice Peckham also granted an order in the case of The People against the Gold and Stock Telegraph Company, in which judgment of $7,500 for plaintiff for unpaid State tax was affirmed by the General Term and the Court of Appeals.

....An incident occurred last Friday showing the enterprise and resources of the Western Union Telegraph Co. in an emergency. On attempting to transmit a report of the transactions of the afternoon Stock Exchange Board from San Francisco, it was found that the wires across the Sierra Nevada would not work, on account of the heavy storm prevailing from Truckee to Alta. After a delay of a few minutes, a complete circuit was made from San Francisco to Virginia City *via* Yreka, California, to Portland, Oregon, a distance of 800 miles; thence 800 miles to Helena, Montana; from Helena to Ogden, Utah, 450 miles, and from Ogden to Virginia City, 650 miles, making a total distance of 2,700 miles that the report of the afternoon board transactions traversed in reaching this city, flashing in their course over a continuous line of wires extending through three States and four Territories, namely: California, Oregon, Washington Territory, Southern Idaho, Montana, Utah and Nevada.—*Virginia (Nev.) Chronicle.*



* * Since the commencement of the year the Government of Guatemala have installed the electric light in that town. Two turbines of 100 horse-power each, established at a distance 5,500 meters (2.79 miles) from the center of the town, supply the necessary driving power.

* * Portable electric lamps are slowly coming into use. A Skrivanor primary battery is placed in the lamp standard, and the glow appears on a burner similar to that of oil lamps. The battery consists of a packet of chloride of silver, two thin zinc plates and a weak solution of caustic potash. This produces a light of twelve-candle power, and will burn for twenty hours, at the end of which time there is no waste of the elements, but the chloride of silver becomes converted into silver and needs revivifying.

* * Successful experiments have been recently made at Cincinnati with the new electric railway brake. The trial was made with a heavy coal train of ten cars, each car weighing, empty, about eleven tons and having a tonnage capacity of 40,000 pounds. The loaded train, with full steam on, was put to a speed of 48 miles per hour on a down grade of 68 feet to the mile, and brought to a dead stop in 37½ seconds after putting on the brake, the distance run in that time being 445 yards, exact measurement.

* * The Pennsylvania Railroad Company continue their experiments with lighting their cars by electricity from Brush storage batteries. They use the lights on a train running between Altoona and Pittsburgh, and the arrangement has worked satisfactorily. The storage batteries are charged in the company's shops by connection with a Brush dynomo-electric machine. It takes about nine hours' running to charge the batteries with sufficient electricity for the round trip. The intention is, should the plan be found advisable for general use on through trains, to establish electric plants at different stations for charging the batteries.

* * The adoption of uniform standards of time all over the world, and of the twenty-four-hour dial—which is probable within a short time—will make some changes in watches and clocks. The American genius for invention, however, has already discounted the change, and a "universal clock" has been constructed, or rather universal dial, which tells the time at any given meridian on the globe. By an ingenious but simple arrangement of figures, the face of the clock shows at a glance over what meridian the sun is at any hour, and which half of the earth is in daylight and which in darkness. Longitude, of course, can be told by the clock immediately from one observation. It ought to prove of great value in navigation, and more especially in schools, where the subject of longitude and time is seldom clearly understood. This clock makes the relation between the two perfectly clear to the eye, as well as to the mind.

* * The revolution which electricity is destined to make in modern warfare is as yet only in its infancy. The latest invention of Mr. Maxim is, however, an earnest of the things that yet shall be. The invention is an electrical training gear, so contrived that by the simple movement of the handle the heaviest gun may be turned by a single man, and with the greatest ease, in any direction. You pull a handle to the right, and the breach of the gun moves to the right; to the left, and it moves to the left. You raise the handle, and the gun is depressed at the muzzle; you depress the handle, and the gun is raised. This training gear was applied a day or two ago to one of the 38-ton guns at Garrison Point Fort, and the preliminary trial showed that one man could train the gun with the greatest nicety. One may expect Providence to be very much on the side of the big guns when a 38-ton gun comes to be aimed at quickly-moving objects as easily as if it were a pistol or a walking stick.—*Pall Mall Gazette.*

* * Dr. Von Waltenfen, with a cell in which the zinc was immersed in sulphuric acid diluted in the proportion of 1 of acid to 15 of water, has found the value D=1 088 volt. The values which are given in old text books are all less than this. Amongst these are the values found by Muller and by Poggendorff, which are expressed in arbitrary units ; but, recalculated in absolute units, they come out 0.971 and 0.922 respectively. The next group of values were determined in absolute measure, but the determinations were made by Ohm's method, which, owing to polorization, would lead to too small a value. They are :

Von Beetz	D=0.936 volt.
"	D=0.887 "
J. Regnauld	D=1.016 "
Buff	D=1.054 "
Bosscha	D=1.026 "

The author's determinations of the E M.F. of the Daniell cell were the first which were made by Poggendorff's second compensation method, and also the first in which Siemens' original resistance apparatus was used. H. F. Weber found the value D=1.0954 volt, on the assumption that one Siemens unit equals 0 956 ohm. Recalculating this value on the basis of the Congress ohm, which is equal to 1.06 Siemens' unit (or 1 S. U.=0.943 ohm), we find D=1.080 volt. Reynier has found D=1.079 volt, and Alder Wright the same value. It is, however, to be noted that the last three experimenters used a solution of sulphate of zinc in the zinc cell. Kittler has found the E.M.F. of a gravity form of Daniell without partition higher than that of a cell with a partition, 1.195 volt in the former case and 1.111 volt in the latter. The author's value, 1.088 volt, was arrived at from experiments with nine different cells, the internal resistance of which varied from 0.38 S. U. to 4.1 S. U.—*Zeitchrift fur Elektrotchn k.*

* * Now electricity promises to furnish just what we want—a means of converting the waste forces of nature into an available form. How vast those forces are, only scientific men are at all aware. The heat of the sun, the wind, the water power of the world's innumerable rivers—above all, that supplied by the motion of the world itself, the force of the tides—afford, each and every one of them, a supply of force incomparably greater than all the possible coal fields of the earth can practically furnish. Sanguine electricians tell us that each and all of these can be rendered available as sources of electric motive power. One eminent inventor already lights his house with electricity derived from the water power of a small stream some furlongs distant. It would be just as easy to apply that power to work sewing machines, lifts, sawpits, or a local railway. The smallest waterfall, the force of an utterly neglected stream, could furnish half-a-dozen households with motive power sufficient for all domestic purposes to which machinery could be applied. The Thames could light London, and have force yet to spare for all the machinery of every factory on its banks. True that the waste, both in conversion and application, will be greater ; that is to say, we shall obtain half, perhaps not a quarter, possibly not more than a tithe of the force which sun and wind, stream and tide, can supply. But we need not calculate or grudge the waste of force that costs nothing, and which as yet is absolutely wasted.

* * * * * * *

But among all the characteristics of the new force, probably the most important, especially in the social and industrial aspect, are its divisibility and conductibility. Niagara, they say, could supply all the factories of the States with water power ; but that power could heretofore be turned to account only on the spot, and therefore only an infinitesimal part of the limitless supply could have been available. As matter of fact, the whole of this vast reservoir of power has been left unused. So little of it could have been utilized that it was not worth while to disfigure the magnificent natural scenery of that unrivaled gorge. But, converted into electric force, the water power of Niagara might be conveyed to an indefinite distance, and distributed in amounts large or small to suit the needs of factories or of families. This is, of course, an extreme illustration rather than a practical example. The potentialities of electricity are accomplished facts. The conversion, the storage, the conveyance and the distribution have all been achieved upon a small scale. That the scale can be enlarged and the methods improved almost indefinitely, those least doubt who have most deeply studied the subject.—*Chambers' Journal.*

The Absolute Value of the Siemens Mercury Unit, and the Length of the Mercury Column Equivalent to an Ohm.

Mr. H. F. Weber corrects the value obtained in 1876-7; according to this correction the mercury uint is equal to $0.9529 \times 10^9 \frac{\text{cm.}}{\text{sec.}}$ (not 0.9550). In 1880 and 1882 the author used the so-called Kirchhoff method of observing the current induced in a second coil on making and breaking the circuit of another coil near it. One coil, A, was laid horizontally on the top of the stone pillar, and the other, B, was supported co-axially just above it on three legs. Both coils were wound on bronze frames, A, with 644 turns, and B, with 643 turns of wire 1.86 mm. in diameter. The width of the coils was 4.30 and 4.31 cm. respectively, and the radius of the outside layer 17.618 and 17.670 cm. The induced current was measured by means of a galvanometer specially constructed for the purpose. The mean of the experiments of 1880 gave the mercury unit equal to 0.9498 ohm. and the mean for 1882 0.9500 ohm, or about one-quarter per cent. less than the former determinations. The mean of 50 observations with a similar but larger apparatus in 1883, gave the mercury unit equal to $0.9496 \times 10^9 \frac{\text{cm.}}{\text{sec.}}$, the highest and lowest values being 0.9509 and 0.9486. Hence, 1 ohm is the resistance at 0° C. of a column of mercury 1 mm.² in section, and 105 32 cm. long.

Profs. Morse and Cross Before the Society of Arts.

Prof. Edward S. Morse read a paper last week at the Institute of Technology, before the Society of Arts, in Boston, on "The Utilization of the Sun's Rays in Heating and Ventilating Apartments." At his residence in Salem the professor had noticed a peculiar effect of the solar rays upon the green Holland curtains suspended before the window of his library. Exposed to the sun, they seemed to radiate heat into the room until the latter became intolerably hot. On examining the curtains Mr. Morse found them presenting a strongly convex surface to the window, and noticed the ascent of heated currents between the two. These phenomena suggested to him the possibility of still further utilizing the direct rays of the sun for the heating of the room, and he replaced the curtains by a sheet of dark silicate paper, beginning an inch or so above the sill of the window. This greatly increased the strength of the current. It then occurred to him that the heat received by the brick wall exteriors of buildings might be employed in the heating and ventilation of the interior spaces To ascertain the extent to which this result could be obtained, Prof. Morse tried an experiment at the Salem Museum—a building with a hall 100 feet in length, 48 feet in width and about 21 feet in height. Instead of silicate paper as the heater, he used a piece of corrugated iron painted black, the windows in front of it being arranged so as to permit the penetration of all the light falling upon them. By this means a flue was formed, through which the air, heated by the rays falling on the corrugated iron, ascended, and at the top made their way into the room or hall. The space experimented upon was from 60,000 to 80,000 cubic feet of air, and although the heating effect was not very perceptible owing to the large capacity of the room, the ventilating effect was great, the whole of the air in the hall being discharged and renewed once and a half or even more in the course of a day. The entering current was, of course, heated, its temperature on ten occasions of observation being 31° Fahr. above the temperature of the outside air ; on one occasion it entered at 16°, and was passed into the hall at 50°.

Subsequently, at Mr. Morse's own house, a receiving surface of slate was employed, with a fronting of glass, the device being so constructed as to shut off the current entering the room, or cause the air of the room to leave by the flue, at pleasure, or to meet exigencies of season. An apparatus of this kind was capable of discharging between 50 and 55 cubic feet of air per minute. In another experiment of the kind, Prof Langley had calculated that 45 per cent. of the heat actually realizable had been utilized—a result which he regarded as remarkable, and upon which he congratulated Mr. Morse. The equivalent in coal had been differently estimated, the amounts given as needed to raise the same quantity of air to the same temperature having varied from 25 pounds to 100 pounds in a single day. The cost of applying the apparatus to the large building was from $275 to $300 ; that of the house heater described was about $18. Mr. Morse offered these results to physicists who had more time than he to carry out the experiments necessary for the further development of the idea. He held, at the same time, that even in its present condition, his plan for the utilization of the solar rays, while it might not cause any revolution in present methods of heating, was eminently applicable to the problem of ventilating schools, churches, and other public buildings. A short discussion followed the reading of the paper.

Prof. Charles R. Cross, in a highly lucid manner, next described new apparatus for the study of telephone currents. His first step was to describe at length the method in which currents are formed in the wires of the telephone circuit, and how the changes in their intensity are made to reproduce vibrations caused by the voice. Any ordinary one-direction current, he showed, was easily measurable by the galvanometer. But the telephone current sometimes ran in one direction, sometimes in another, the alternations being very rapid. To obtain indications of such currents as these, a special galvanometer had to be used. It was formed of one coil of wire inserted within another, the center coil being kept in position by a torsion suspender. A current sent through both these coils at the same time tended to bring them both into a position of parallelism toward each other. When reversed, the current was reversed in both coils at the same time, the effect upon the center coil being thus not intermittent but continuous, and in the same direction, according to the strength of the current, no matter how often it might be reversed. The center coil carried a mirror reflecting a beam of light upon the wall, and as the tendency was toward parallelism or away from it, the spot of light was moved as on a scale. This experiment was tried with great success. When the loud speaking transmitter was used, the deflection was very marked ; the Bell telephone gave results much inferior. It ought to be mentioned that the effects were only produced with single vowels, such as a, o, u and y, Judging from the results thus far obtained, Prof. Cross was enabled to declare the telephone current to have an enormously greater strength than it has hitherto been supposed to possess.

Mr George W. Blodgett having exhibited Boynton's train indicator, the meeting was adjourned.

Editors of the Electrical Review :

DEAR SIRS :—I notice an article in this week's REVIEW which states, that among the new uses of electricity is that of obtaining butter from milk by passing the current through the same. About two years ago while residing in New Berlin, N. Y. I tried with entire success an experiment identical

with the above. I used as a source of current a four-light dynamo electric machine, and constructed apparatus for the speedy conversion of milk into butter in this way, but found after experimenting some time, that the butter contained a large per cent. of the metal composing the positive electrode and forming in every case a highly poisonous salt. I obtained very good results, however, with electrodes composed of carbons. I also found that the current if allowed to flow with the same strength at the end of the process as at the beginning would instantly melt the forming butter into oil. There seemed to be a gradual falling off in resistance toward the last, and in order to get good results, considerable skill was required in regulating the current. The ratio of decrease in resistance varied with every specimen. I tried and was most constant when the milk was fresh from the cow.

The idea of obtaining butter by the use of electricity was suggested to me by Mr. Hallam Eldridge, of Binghamton, N. Y., who has also experimented in the same direction.

GEO. J. MURDOCK.

An Electric Street Railway.

A test of the Henry electric street railway system was to have been made at Kansas City, Mo., last week, but a break in the gearing compelled the postponement of the trial for two weeks or more. The system was tested at the works recently, and is described as follows by the *Journal* of Kansas City:

A Westport car stood in the shop on two rails about twenty-five feet long. A Van-Depoele electric generator stood in one corner of the building, and from it two wires conveyed the current to an electric box in the roof of the car, and from there the current passed on wires through the motor, which is placed on the front platform and is connected with the axles by cogwheels.

The car was raised from the floor by jack-screws so that the wheels could revolve without touching the rails, and the generator was set in motion. Mr. J. C. Henry, the inventor of the apparatus, mounted the platform, and by turning a crank the wheels of the car revolved at the rate of thirty-five miles an hour. Mr. Henry then showed those present how any rate of speed could be obtained by simply turning the wheel. He stopped the wheels while at full speed and reversed them almost instantly, and the whole thing worked to perfection. Over the street car track two wires will be placed on poles high enough not to obstruct traffic on the road. These wires will be connected with generators at different points on the roadside. A small train will then be placed on the two parallel wires, and this train will be connected to the street car by wires, then, when the current starts the car, it will pull the train along the parallel wires overhead, so that the current will be continuous.

Mr. J. C. Henry, in reply to a question as to how the car could be prevented from slipping down hill, said: "The car cannot slip, and even if it should, it could be stopped by reversing."

"What speed can be attained?"

"There is no limit to the speed. It can be regulated to any rate, either fast or slow."

"What power has the appliance on this car?"

"About six-horse power, or sufficient to pull two loaded cars up any grade."

"Do you think the electric power superior to that of the cable?"

"Yes, it is cheaper and better. Cable power is wasted; only 30 per cent. of it is utilized, the balance goes to move the heavy cable and machinery. We get from 60 to 70 per cent. of the energy on the car of the stationary engine. The best locomotive made consumes seven pounds of coal per horse-power, and we will use engines that will be guaranteed not to consume more than one and one half or two pounds of coal per horse-power."

"You must join us on the trial trip, which will take place in a few days," said the millionaire president of the Westport line.

"Yes," said Mr. Henry, jokingly, "and we will promise not to let you walk back in the mud."

Dangers of Sound-Reading.

Now that the sounder is becoming so universally used throughout the service, I beg for space in your paper to make a few observations on sound reading. A great deal has already been said and written on the saving which has been effected by the introduction of the sounder instrument, but very little has been heard of the dangers to which sound-readers are exposed.

My object, then, is to bring under the notice of your wide and interested circle of readers what the dangers are, and by what means they can best guard against them.

I may in the first place mention that my observations are the result of long practical experience as an operator, together with carefully gathered information from my brother and sister clerks who have been sound-readers for years.

It is said by certain scientific men that the sense of hearing is a more interior sense in the brain than the sense of sight, and that, consequently, the brain is more intensely active when the ear is conveying sound to it than when the eye is conveying the impression of objects. I do not think there are many sound-readers who will doubt this scientific theory, nor will they doubt the writer's belief that, no matter how healthy the brain may be, sooner or later prolonged sound-reading results in a weakening of this organ to act as a medium to the will, and predisposes to disease other important organs.

It is, then, brain disease affecting either the physical or mental powers of the body to which sound-readers are exposed. The fact is well known that no one can escape the law of nature which is the judge over every atom of the physical organism, neither can we prevail successfully against the operation of the law for any length of time, for

> It knows not wrath or pardon, utter true
> Its measures mete, its faultless balance weighs;
> Times are as naught, to-morrow it will judge
> Or after many days.

Obey and live, disobey and die, is the stern mandate engraven on every organ in the human body.

When I mention that the dreaded disease, insanity, is becoming very prevalent in the service I merely state what is a plain truth. In an important Scotch office no fewer than three cases of this disease have occurred within the past year, and it may be proper to mention that this same office has been largely using the sounder for several years. Unfortunately, the writer is not at present able to say in what proportion brain diseases, more particularly insanity, affects telegraph clerks in America, where the sounder is almost universally in use; but he is under the impression that climatic influences greatly assist the American telegraph clerk to preserve his nervous system in a normal state of health for a much longer period than the operator can do in this country.

To substantiate my belief in climatic influences, I quote an eminent writer, who says: "That the state of the atmosphere has prodigious effect on human temperament is sufficiently indicated by the character of nations. The Frenchman owes his sanguine hopes, his supple limbs, his untiring vivacity to a genial climate. To this, also, in a great measure, the Italian owes his pliant gracefulness and impulsive warmth. The Dutchman, in his level marshes, could never dance 'La Sylphide,' nor the Scotch girl, on her foggy hills, become an *improvisatrice*."

Although the day cannot be far distant when the department will have to make inquiry into brain disease in the service, the writer would, in the meantime, ask your readers to remember the old proverb, "Prevention is better than cure." He would, therefore, advise all sound readers never to lose perfect control over themselves, as many are so apt to do, when they have fast jerky, unsteady sending to read. Under a state of excitement, a great waste of nervous energy takes place, and our period of rest not being sufficient to redeem this waste, we day by day enfeeble those organs which alone make life endurable and worth living. Sound-readers should at all times check fitfull or excited working at the wire, ever keeping in mind that the steady and quiet worker is by far the most valuable public servant. Those who work at all times under a state of nervous excitement very soon become useless to the department, act as an irritant to their fellow-clerks, and add their load to the world's great mountain of misery and disease

What seems to the writer to be required in the service is an instrument which would combine the qualities of being a good sounder and recorder, so that the eye might relieve the ear, or the ear the eye, when the necessity arose for either the one or the other requiring relief.

While wishing to be grateful to the department for what it has already done for us, still the fact cannot be overlooked that much has yet to be undertaken before the service is placed on a satisfactory footing as regards health. It is, for instance, not unusual to find the telegraph office placed in some obscure or underground part of the building, where the ventilation is bad, and where the air is almost motionless, and hence lacking those virtues which act so beneficially on the entire nervous system.

In these days of high-pressure working, it is very essential that the air should be in active circulation, so that all telegraph offices should be on the top of the building, where this condition of the atmosphere could be better obtained.

As is the case in many branches of the Civil Service, six hours a day and six days per week are considered long enough for work which demands very little brain activity, and in which the nervous system is seldom unduly excited; what, then, the writer asks, must be the consequences that follow working for eight hours for thirteen days at a stretch, in the very vortex of activities? The answer is to be found in the lunatic asylums, where the writer's fellow-clerks are confined; the answer is to be found in the verdict of the coroner's jury in a recent investigation as to the cause of death of one of our number; the answer is to be found in the annual report of the United Kingdom Postal and Telegraph Benevolent Association, from which we find that, while nineteen telegraph clerks died in benefit, two of the nineteen committed suicide; the answer is to be found in the jaded and worn-out appearance of male and female clerks, who are unfit for exertion of any kind after sitting with their ear to a sounder for eight hours.—*The Telegraphist, London.*

A Chance for Electricians.

Electricity has done much for the railroad, but there is good reason to believe that what it has done, compared with what there is likelihood it will do in the future, is as nothing. Just now what the railroads most want is a system of signaling that will prevent collisions under all conditions, and the electrician that can invent such a system may look for mach profit and no little fame.

Many attempts, as we know, have been made by electricians to solve this important problem, and some very ingenious contrivances have resulted, the most notable being those devised by Phelps, on the one hand, and Edison, on the other. The first, on its public trial, did not give the results we had looked for, and the latter, which is even more ingenious, has not yet been publicly tried, and hence it is impossible to say how near it comes to the ideal railway signal apparatus.

There are some things that electricians should bear in mind while constructing mechanisms designed for use on the railroad. All such contrivances should be of simple construction, and have few parts. A vitally important part is that, in all cases where a break occurred in the apparatus, "danger," and not "safety," should be shown on the target. In other words, it should only be possible to show the "safety" signal when the apparatus was in smooth running order; at all other times, "danger." Having seen all the principal mechanisms for railway signaling, we can say, without the fear of contradiction, that most of them are too complex, and all that have yet been successfully shown in public have relied upon the intelligent action of a single human being in the one part or in the other. That this is a fatal defect the experience of every railroad in the country goes to prove; for, though such an appliance may work successfully five hundred times, it will fail on the five hundred and first, and yet the perfect working in all these five hundred cases may not atone for the injury to life and property caused by the slip on the five hundred and first.

Again, no electrician should begin to work on a railway signaling apparatus before he has carefully examined all those now in use which possess merit, and learned the exact nature of their defects.

ELECTRIC LIGHT NEWS

—— There are 600 arc lamps (Brush) in operation in the city of Buffalo, nearly 400 of which are used by the city, which is well lighted.

—— The New Bedford Electric Light Company has declared quarterly dividends of 2 per cent. on old stock, and of 1 per cent. on new stock.

—— Inquiries for electric lamps that are really practical and satisfactory are being constantly made. Will the inventor of one please stand up and be counted?

—— The Boulton Carbon Company have secured the exclusive agency for North America for the Austrian soft-cored carbon, for which there is quite a demand in certain special cases.

—— The manufacturers of electric light engines are quite generally reporting an improvement in business that has gradually made itself known during the past six or eight weeks.

—— "Wall, naow, did you ever?" exclaimed Farmer Furrow, as he saw the Edison electric light for the first time. "I didn't know that they could burn kerosene oil upside down."

—— The New Haven Electric Light Company, New Haven, Conn., are earning 16 per cent., and paying 8 per cent. regular dividends. Their business is constantly increasing, and they have ordered the fourth Armington & Sims' engine.

—— With reference to a paragraph in our last issue relating to the practical realization of the *legal ohm*, we desire to correct a typographical error. The value of the ohm is not as we are made to state it, but, as is well known, is represented by the resistance of a column of mercury 106 centimeters in height, and one square millimeter in cross section at the temperature of 0° centigrade.

—— Our readers will notice among advertisements the announcement of Messrs. Stout, Meadowcroft & Co., the authorized agents of the Edison Electric Light Company, of various interesting devices relating to electric lighting by battery power. Among the recent developments in electrical inventions, none have been more rapid and interesting than the many uses to which the small incandescent lamps have been put. A new feature appears in this advertisement, which seems to promise great convenience. We refer to a dry salt for bi-chromate batteries, which merely requires the addition of cold water to make an ordinary bi-chromate solution.

—— The *Mail and Express* says that no preliminary experiments with the electrical motor power applied to the elevated railways will adequately prepare the public for the great improvements in our aerial railway traveling that will be in full operation within sixty days—improvements without precedent in the history of the successive developments of modes of locomotion. When the cars on the elevated railways are supplied with electric motors, the changes will be wonderful. 1st. There will be none of the noises caused by the locomotives. Trains will move almost without noise—with so little noise that it will not be audible from the surface of the street. 2d. Of course the smoke and cinders of locomotives will no longer exist. 3d. The ability of the, at present, overcrowded and overworked elevated railways to carry passengers will be indefinitely increased, because, as each car is supplied with its own motor, trains can be lengthened and shortened according to the demand, and the delays and trouble of switching will be done away with altogether. In fact, within sixty days, New Yorkers will enjoy the perfection of rapid transit, and in their streets will be seen the latest and best results of electrical science and invention.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 14, 1885.

315,473 Electric Arc Lamp; William F. Buckley, Cleveland, Ohio.

315,498 Circuit for Electric Switch Signals; Alvah W. Hall, Meriden, Conn., assignor to the Hall Railway Signal Co., same place.

315,524 Electric Lamp; Mirabeau N. Lynn, Rising Sun, Ind., assignor to the Ohio Power and Light Company, Dayton, Ohio.

315,526 Aerial Conduit for Electric Wires; Donald B. Macquarrie, Kansas City, Mo.

316,564 Electric Arc Lamp; Frank M. Sparrow, Mattapoisett, Mass.

315,568; Telegraphic Relay; Frederick Stitzel and Charles Weinedel, Louisville, Ky.

315,571 Voltaic Arc Lamp; George A. Taborum, Marseilles, France.

315,633 Electrical Insulator; Henry Kellogg, New Haven, Conn.

315,658 Multiple Switchboard; Thomas J. Perrin, Brooklyn, N. Y., assignor to Charles P. Huntington Greenville, Mass.

315,660 Supporting Insulator for Telegraph Wires; Henry Prenzel, Philadelphia, Pa.

315,673 Electric Coupling; Thomas T. Smith, Finsbury, London, England.

315,674 Electric Light Apparatus; Thomas T. Smith, Finsbury, London, England.

315,763 Telegraphic Sounder; James F. Gilliland, Indianapolis, Ind.

315,772 Railway Signaling Apparatus; William Hadden, Brooklyn, N. Y.

315,783 Automatic Call for Latent Signal Transmitters; F. Benedict Herzog, New York, N. Y.

315,785 Electric Railroad Signal; Justin Hinds and Lorenzo L. Stimpson, Boston, Mass.

315,841 Conduit for Cable or Electric Railways; Edward Samuel, Philadelphia, Pa., assignor to Wm. Wharton, Jr., & Company, same place.

315 862 Telephone; William L. Voelker, Morton, Pa., assignor to John H. Irwin, same place.

315,937 Electric Battery; Alfred Haid, Rahway, N. J., assignor to the Excelsior Electric Apparatus Company, New York, N. Y.

315,938 Galvanic Battery; Alfred Haid, Rahway, N. J., assignor to the Excelsior Electric Apparatus Company, New York, N. Y.

315,941 Bell for Latent Signal Transmitters; F. Benedict Herzog, New York, N. Y.

315,954 Underground Conduit; Albert E. Lytle, Chicago, Ill., assignor of part interest to Robert B. Smith, same place.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

Business Notices.

We beg leave to call your attention to the fact that the stock of the "Central Union Telegraph Company" has been regularly listed on the Chicago Stock Exchange.

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